Cometary Observations at the Liverpool Observatory. By W. E. Plummer, M.A

Observations of Comet b 1902 (*Perrine*).

Greenwich Mean Time of Observation.				♂ − ✶ Ret.	No. of Comp.	Apparent R.A. of ♂.			♂ − ✶ Decl.	No. Comp.	App. Decl. of ♂.			Log. Factor of Parallax α.	Log. Factor of Parallax δ.	Star of Comp.
		h	m	s	m s		h	m	s	′ °		°	′	″			
Sept.	3	10	22	50·4	−2 19·45	35	3	15	36·34	− 3 0·3	5	+35	37	15·2	−9·6345	0·7635	*a*
		10	22	50·4	−3 35·69	25	3	15	36·40	− 3 1·7	5	+35	37	15·9	−9·6345	0·7635	*b*
	4	10	27	46·0	−2 40·61	16	3	14	29·42	+ 3 27·7	5	+36	3	19·7	−9·6369	0·7615	*c*
	5	10	2	35·1	− 0·49	20	3	13	15·95	− 1 4·4	5	+36	30	8·0	−9·6370	0·7774	*d*
		10	2	35·1	+1 14 02	20	3	13	15·89	+ 1 47·2	5	+36	30	8·8	−9·6370	0·7774	*e*
	6	10	40	26·0	+2 47·41	16	3	11	50·32	+ 5 9·5	4	+36	59	26·9	−9·6412	0·7315	*f*
	8	10	2	16·9	−2 5·10	20	3	8	37·26	− 1 46·4	5	+37	59	57·8	−9·6477	0·7551	*g*
	18	10	4	31·2	+ 3·45	15	2	35	28·36	+ 1 25·2	6	+45	6	1·1	−9·6787	0·5948	*h*
	19	10	29	24·8	−2 29·10	16	2	29	22·18	− 4 10·9	5	+46	3	53·4	−9·6614	0·5173	*i*
	23	8	18	16·0	−2 41·71	16	1	56	28·92	+ 3 26·2	5	+50	14	1·2	−9·7388	0·6558	*j*
	24	8	2	0·3	+ 3·90	15	1	44	49·89	− 4 34·3	4	+51	22	43·3	−9·7485	0·6136	*k*
	25	7	47	10·9	+ 1·86	15	1	31	20·92	− 1 42·2	6	+52	31	55·2	−9·7592	0·5962	*l*
	26	7	30	30·1	−2 4·68	16	1	15	46·55	− 4 16·9	6	+53	39	46·7	−9·7677	0·5394	*m*
	28	9	3	20·1	− 6·79	16	0	34	55·64	−14 16·7	5	+55	46	2·9	−9·6530	9·9772	*n*
Oct.	1	7	25	45·7	+2 43·07	10	23	15	18·99	− 6 39·9	3	+57	0	38·0	−9·6893	9·9654	*o*
	2	7	31	16·3	+1 52·99	15	22	43	21·66	− 3 46·8	5	+56	34	14·9	−9·5900	9·6037	*p*
	5	7	14	11·2	+5 3·24	12	21	8	49·92	+ 4 43·7	4	+51	41	55·9	−9·1762	9·5806	*q*
		7	14	11·2	+4 32·89	12	21	8	50 25	+ 2 12·3	4	+51	41	58·0	−9·1762	9·5806	*r*
	8	7	26	10·4	+ 27·43	16	19	54	30·45	− 20·8	5	+42	22	22·9	+8·8893	0·2304	*s*
	11	7	6	29·2	−1 7·84	12	19	5	21·88	− 6 52·7	3	+31	46	44·7	+9·1434	0·5592	*t*

Sept. 3. The comet presents a well-marked condensation to which the observations refer. Sept. 8. The sky somewhat cloudy, but the comet fairly well seen. Sept. 18. Moonlight troublesome. Sept. 28. Connected with *α Cassiopeiæ* by means of an intermediate star; the observation not very satisfactory. Oct. 5. Sky hazy, comet faint; found with difficulty.

Mean Places of Stars of Comparison.

Star's Designation or Authority.		Mean R.A. 1902·0. h m s	Corr. to Apparent Equinox. s	Mean Decl. 1902·0. ° ′ ″	Corr. to Apparent Equinox.	Letter of Reference.
A. G. C. (Lund)	No. 1747	3 17 51·81	+3·98	+35 40 14·6	+ 0·9	*a*
,, ,,	No. 1762	3 19 8·12	+3·97	+35 40 16·8	+ 0·8	*b*
,, ,,	No. 1744	3 17 5·98	+4·05	+35 59 50·4	+ 1·6	*c*
,, ,,	No. 1712	3 13 12·34	+4·10	+36 31 11·0	+ 1·4	*d*
,, ,,	No. 1700	3 11 57·77	+4·10	+36 28 20·2	+ 1·4	*e*
,, ,,	No. 1673	3 8 58·75	+4·16	+36 54 15·6	+ 1·8	*f*
,, ,,	No. 1688	3 10 38·09	+4·27	+38 1 42·6	+ 1·6	*g*
A. G. C. (Bonn)	No. 2271	2 35 19·83	+5·08	+45 4 30·7	+ 5·2	*h*
,, ,,	No. 2219	2 31 46·08	+5·20	+46 7 58·6	+ 5·7	*i*
,, ,,	No. 1769	1 59 5·19	+5·44	+50 10 27·5	+ 7·5	*j*
A. G. C. (Cambridge, Mass.)	No. 846	1 44 40·23	+5·76	+51 27 6·3	+11·3	*k*
,, ,, ,,	No. 722	1 31 13·20	+5·86	+52 33 24·4	+13·0	*l*
,, ,, ,,	No. 618	1 17 45·24	+5 95	+53 43 48·9	+14·7	*m*
α Cassiopeiæ		0 34 56·44	+5·99	+55 59 59·6	+20·0	*n*
A. G. C. (Helsingfors)	No. 13903	23 12 30·60	+5·32	+57 6 48·9	+29·0	*o*
,, ,, ,,	No. 13398	22 41 23·80	+4·87	+56 37 30·1	+31·6	*p*
A. G. C. (Cambridge, Mass.)	No. 6906	21 3 43·39	+3·29	+51 36 36·5	+35·7	*q*
,, ,, ,,	No. 6908	21 4 14·06	+3·30	+51 39 10·0	+35·7	*r*
A. G. C. (Bonn)	No. 13585	19 54 0·61	+2·41	+42 22 28·3	+33·8	*s*
Leiden Zones, 65	No. 70	19 6 27·62	+2·10	+31 53 8·0	+29·4	*t*

H 2

On Jacobi's Method of Facilitating the Numerical Solution of Equations arising in the Theory of Secular Perturbations. By H. C. Plummer, M.A.

1. The equations to be considered here are of the type

$$\Delta = 0$$

where Δ is a symmetric determinant which may be written in the form

$$\begin{vmatrix} A_{11} - \lambda, & A_{12}, & \ldots & A_{1n} \\ A_{21}, & A_{22} - \lambda, & \ldots & A_{2n} \\ — & — & \ldots & — \\ A_{n1}, & A_{n2}, & \ldots & A_{nn} - \lambda \end{vmatrix}$$

and which is no other than the familiar discriminating determinant which occurs in so many branches of mathematics. As it arises in the determination of the mean motions of the perihelion and the node, the number of rows and columns corresponds to the number of the planets. In the application to the solar system the determinant is of the eighth order; and little reflexion is necessary to see that its direct reduction would entail enormous labour. Hence Jacobi's method * of approximating to the numerical values of the roots without reducing the determinant is of great practical interest.

2. The principle of Jacobi's method may be briefly recalled. The vanishing of Δ is the condition of the consistency of the system of n linear equations

$$\begin{aligned} (A_{11} - \lambda)x_1 + A_{12}x_2 + \ldots + A_{1n}x_n &= 0 \\ \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \quad \cdot \\ A_{n1}x_1 + A_{n2}x_2 + \ldots + (A_{nn} - \lambda)x_n &= 0 \end{aligned}$$

where $A_{rs} = A_{sr}$. Let $[i]$ and $[k]$ denote the ith and kth equations. The substitution

$$\begin{aligned} x_i &= \chi_i \cos\alpha - \chi_k \sin\alpha \\ x_k &= \chi_i \sin\alpha + \chi_k \cos\alpha \end{aligned}$$

is made and $[i]$ and $[k]$ are replaced by $[i]\cos\alpha + [k]\sin\alpha$ and $-[i]\sin\alpha + [k]\cos\alpha$. Then if

$$\cot 2\alpha = (A_{kk} - A_{ii})/2A_{ik}$$

the eliminant of the equations thus transformed is a symmetric determinant of exactly the same *form* as before. If A'_{rs} be the constituent corresponding to A_{rs} in the transformed determinant, we have

* 'Über ein leichtes Verfahren die in der Theorie der Säcularstörungen vorkommenden Gleichungen numerisch aufzulösen,' *Werke*, vol. vii. p. 111; Crelle, vol. xxx. (1846), p. 64.